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This Position Document addresses the risks and benefits of pesticide products containing the subject active ingredient. The Agency has determined that the use of products containing the subject active ingredient may meet or exceed a risk criterion described in 40 CFR Part 154. Potential hazards will be examined further to determine the nature and extent of the risk, and considering the benefits of the subject active ingredient, whether such risks cause unreasonable adverse effects on the environment.

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STRYCHNINE POSITION DOCUMENT 4

September 30, 1983

Office of Pesticide Programs

Environmental Protection Agency

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Washington, D.C. 20460

Executive Summary

The Rebuttable Presumption Against Registration (RPAR) notice for strychnine was published in the Federal Register of December 1, 1976. The presumption was against all outdoor above-ground uses of strychnine. Three other actions by the Federal government involving strychnine should be noted. In March of 1972, Executive Order 11643 was issued. This order prohibited the use of all toxicants, including strychnine, for control of predators on Federal lands or in Federal programs. In the same year, the Environmental Protection Agency (the Agency) cancelled the registrations of thallium sulfate, cyanide, strychnine and compound 1080 for predator control. Additionally, in February 1978, the Agency restricted use of several pesticides, including strychnine formulations with concentrations greater than 0.50 percent, for use only by certified applicators. The criteria influencing the restriction for strychnine were acute oral toxicity, hazards to nontarget species, and use and accident history.

The RPAR criteria that were determined to have been met or exceeded for the outdoor above-ground uses of strychnine are: 1) acute toxicity to mammals and birds, and 2) significant reduction in populations of nontarget organisms and fatalities to members of endangered species.

The Position Document 2/3 (PD 2/3) detailing the proposed Agency decision was published on November 5, 1980 (45 FR 73602). In this document, the Agency proposed cancellation of certain uses and modifications to the terms and conditions of registration of others to effect protection to nontarget organisms. These modifications included reduction and standardization of bait concentrations, standardization of baiting procedures, and use restrictions for the protection of endangered species. The Agency received comments both on the PD 2/3 and a preliminary draft of the PD 4. All of these comments have been evaluated and the information has been used for the development of the Agency's final decision as found in the conclusions chapter of this document.

In this PD 4, the Agency's final decision is to cancel strychnine uses for the control of prairie dogs, deer mice, meadow mice, chipmunks and marmots/woodchucks on rangeland/pastures and cropland, and also to cancel strychnine uses for the control of all rodents and small mammals, with the exception of ground squirrels, marmots/woodchucks (around rock piles and lava outcrops), jackrabbits (around airports), and porcupines on nonagricultural sites. The Agency also has decided on label modifications for uses involving ground squirrels, jackrabbits, kangaroo rats, and cotton rats on rangeland/pastures and cropland; ground squirrels, marmots/woodchucks, jackrabbits and porcupines on nonagricultural sites; and birds on cropland and nonagricultural sites. Efficacy data will be required for ground squirrels to determine the lowest efficacious dosage.

Prairie dog control accounts for approximately 20 percent of the use of strychnine bait. The other uses of strychnine that will be cancelled are all relatively minor. The total portion of strychnine use being cancelled is between 20 and 25 percent.

The Agency's decisions for the cancellations was based on an evaluation of the risks and benefits of each use, considering such factors as risks to nontarget and endangered species, availability and risks associated with the alternatives, demonstration of benefits, and the feasibility of risk reduction measures. Where the evaluation indicated the risks outweighed the benefits, the use was cancelled.

The protection of endangered species is critical to the decisions in this PD 4. The U.S. Fish and Wildlife Service, Office of Endangered Species, has been consulted and their recommendations have been fully considered in arriving at the final decision.

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I. INTRODUCTION

A. Background

This Position Document 4 (PD 4) concludes the Rebuttable Presumption Against Registration (RPAR) process for strychnine. Strychnine is a rodenticide used to control rodents, lagomorphs (rabbits, hares and pikas) and birds on rangelands, croplands and nonagricultural sites. This RPAR addresses only the outdoor, above-ground uses of strychnine. Strychnine is usually used in a grain bait, although a small amount is incorporated in green baits such as chopped cabbage. Approximately 90 percent of the strychnine bait is used for rodent control and 10 percent is used for bird control. Of the portion used for rodent control, approximately 75 percent is used to control ground squirrels and approximately 20 percent is used to control prairie dogs.

Approximately one-half million pounds of strychnine bait were used annually for above-ground control of rodents, lagomorphs, and birds during 1977-1978. The majority of the bait usage was in 17 western states for controlling ground squirrels and prairie dogs. Rangeland/pasture use and cropland use were approximately equal and accounted for 91 percent of the strychnine bait. The other nine percent was used on nonagricultural sites.

Currently 116 strychnine products are Federally registered for control of major rodent pests (including ground squirrels, prairie dogs, house mice, and field mice); minor rodent pests (including chipmunks, marmots, kangaroo rats, cotton rats, porcupines, and jackrabbits); and birds (pigeons and house sparrows).

In addition, 277 products have state registrations. Certain states have issued their own state registrations for strychnine uses covered by Federal registrations. Also, specific states have issued their own registrations for uses not covered by Federal registrations. For example, California has registered strychnine use for control of marmots, rabbits, blackbirds, cowbirds, horned larks, house finches, white-crowned sparrows, and golden-crowned sparrows. Wyoming has registered strychnine use for control of mountain beavers, opossums, marmots and magpies. Nevada has registered strychnine use for control of magpies, and Oregon has registered strychnine use for rabbits.

The United States Environmental Protection Agency (the Agency) issued the RPAR for strychnine on December 1, 1976. The Position Document (PD 1) that accompanied the RPAR presented the Agency's reasons for the presumption and presented an opportunity for public comment. The basis for the RPAR was a perceived risk to nontarget animals, including certain endangered species. The Agency published another Position Document (PD 2/3) on November 5, 1980. That document contained comments received in response to PD 1, provided a risk/benefit analysis of each strychnine use and each regulatory option, and presented the Agency's proposed actions. The proposed actions were designed to reduce risks to the point where they would be exceeded by the benefits of use. In some instances, this necessitated proposals to cancel certain uses.

B. Summary of Actions Proposed in PD 2/3

For each outdoor, above-ground use of strychnine the Agency proposed either cancellation of use, continued registration without modification, or modification of the terms and conditions of registration.

For rangeland and pasture uses, the proposed action for each pest was:

ground squirrels	-	modification of the terms and conditions of registration
prairie dogs	-	cancellation
deer mice	-	cancellation
meadow mice	-	cancellation
chipmunks	-	cancellation
marmots/woodchucks	-	cancellation
cotton rats	-	modification of the terms and conditions of registration
kangaroo rats	-	modification of the terms and conditions of registration
jackrabbits	-	modification of the terms and conditions of registration

For cropland uses, the proposed action for each pest was:

ground squirrels	-	modification of the terms and conditions of registration
prairie dogs	-	cancellation
deer mice	-	cancellation
meadow mice	-	cancellation
chipmunks	-	cancellation
marmots/woodchucks	-	cancellation
cotton rats	-	modification of the terms and conditions of registration
kangaroo rats	-	modification of the terms and conditions of registration
jackrabbits	-	modification of the terms and conditions of registration
birds	-	modification of the terms and conditions of registration

For nonagricultural site uses, the proposed action for each pest was:

jackrabbits	-	cancellation
chipmunks	-	cancellation
marmots/woodchucks	-	cancellation
prairie dogs	-	cancellation
kangaroo rats	-	cancellation
cotton rats	-	cancellation
deer mice	-	cancellation
meadow mice	-	cancellation
mountain beavers	-	cancellation
opossums	-	cancellation
rabbits	-	cancellation
ground squirrels	-	modification of the terms and conditions of registration
porcupines	-	modification of the terms and conditions of registration
pigeons	-	modification of the terms and conditions of registration
house sparrows	-	modification of the terms and conditions of registration

The modifications included reductions in active ingredient concentration, uniform baiting and post-baiting procedures, and special restrictions for the protection of endangered species.

C. Organization

This document is organized into five chapters. The first chapter is this introduction. Chapter II responds to comments received on the Agency's risk analysis and presents the Agency's final risk determinations. Comments considered were those that argued against both the presumption of risk and the Agency's conclusions on the degree of risk. Additionally, Chapter II responds to comments addressing the efficacy and utility of proposed actions. Chapter III includes

comments on the costs of using strychnine and alternatives and the impacts of cancelling or modifying strychnine uses. Also considered in Chapter III are comments on the efficacy of alternatives and the Agency's final determination as to the potential impact of strychnine cancellation. Chapter IV is the Agency's response to comments on the risk/benefit analysis, regulatory options, and proposed actions. Chapter V presents the Agency's conclusions regarding comments received and the Agency's final actions for each use.

II. COMMENTS ON THE RISK ASSESSMENT

All the above-ground, outdoor, pesticidal uses of strychnine were examined by the Agency because of their potential for killing nontarget species, either directly or by indirect poisoning.

After reviewing and evaluating all the existing data and public comments the Agency determined that all outdoor, above-ground pesticidal uses of strychnine pose some risk to nontarget species. Although the data base is small, it indicates that species other than target species may feed on baits treated with strychnine and that scavanging may occur on animal carcasses killed by strychnine poisoning. In some instances, this will cause nontarget species mortality. Obviously, this occurrance is especially critical should the nontarget animal be a member of an endangered species. The Agency is aware of data which indicates that nontarget poisoning occurs when strychnine baits are distributed in the environment. Although the Agency is unable at this time to assess the risks to nontarget species in a quantitative manner, the existence of environmental risk due to outdoor, above-ground use of strychnine pesticides has been clearly established.

The purpose of this chapter is to review and evaluate comments submitted to the Agency in response to PD 2/3 and to revise, as appropriate, the determination of risks used to reach the risk/benefit decisions on the above-ground uses of strychnine.

Comments regarding risks associated with uses of strychnine are organized into four sections:

A. "Significance" of impact on nontarget populations including whether the RPAR criterion has been met;

B. Extrapolation of secondary risks from toxicological data;

C. Specifics on endangered species;

D. Risk reduction methods, including use of dyed baits, buffer zones, standardization of toxicant concentration and alternatives.

The following sections discuss substantive comments organized by major topic or issue and present the Agency's conclusions regarding risks based on these comments.

A. "Significance" of Impacts on Nontarget Organisms

USDA (pp. 7-8)[1/] proposed that the Agency adopt a system of classifying environmental impacts patterned after that used by the Atomic Energy Commission, ranging from "nonsurvivable" events (catastrophes) through those resulting in systematic degradation of the whole, characterized by frequent degradation of parts ("minor" but frequent). While the Agency has not formally adopted such a system for use in guiding its regulatory decision on pesticides, the Agency agreed with the intended philosophy and

1/ The USDA rebuttal (Respondent #81) was very extensive and contained twelve exhibits. In this PD 4, all citations of the USDA rebuttal will be referred to as USDA with the appropriate exhibits or page numbers instead of the assigned respondent number.

has employed it throughout the PD 2/3. The Agency's proposals ranged from taking no action, through employing risk reduction measures, to cancellation.

The Agency believed that quantitative approaches to risk assessment are desirable, but that a limited data base hinders the achievement of such goals. The USDA stated that:

> "The PD 2/3 risk analysis utilized a select set of exclusive references and information and ignored equally capable, if indeed not better scientific data and information . . . . The risks to wildlife, which rely on EPA-sponsored tests, appear to have been designed to maximize the hazard to nontarget species and thereby increase the subsequent risks. Field rodenticide history does not support the stated results of the exposure to nontargets as estimated by EPA-sponsored strychnine field rodenticide baiting tests. [Dempster, 1977; and Shaffer, 1981]"

The "EPA-sponsored" strychnine field rodenticide baiting tests to which the USDA referred were conducted by the U.S. Fish and Wildlife Service (FWS) and included one study on pocket gopher control (Hegdal and Gatz, 1977b) and one on Richardson ground squirrels (Hegdal and Gatz, 1977a). The first involved subsurface application of strychnine baits, which was not included in the RPAR because of the perceived low risk to nontargets. The second study monitored a control operation conducted independently in Carbon County, Wyoming. The Agency cannot determine how the USDA arrived at the conclusion that the second study was intentionally designed to maximize hazard. Neither the Agency nor the FWS had any influence over the conduct of the control operation. The Agency has not received the "better scientific data" which the USDA believes to be available on this question. While two references (Dempster, 1977 and Shaffer, 1981) cited by USDA provide useful background for developing conservation plans for wildlife, neither mentioned risks from strychnine or any other pesticide.

Citing tests conducted in Montana, USDA (p. 13) noted that "Post-treatment observations showed that other carnivores were not extirpated, even on treated areas. Contrary to EPA's risk analysis, USDA argued that the population at risk during treatment seasons will not be near the minimum viable level and could easily recover reductions shown to occur when dyed strychnine bait is used above-ground for field rodent control [Malloy, 1981; USDA Reference 7]." Malloy also stated, "Carcass recovery indicated that mortality may be locally high where carnivores are traditional users of a treated area." Since USDA's position (p. 11) was that "EPA has not established that, as a result of the toxicity, significant adverse effects have actually occurred in local, regional or national populations of nontarget species," it would appear from their interpretation of this example that the definition of "significant" is at issue. The Agency does not believe that its concerns should be limited to events that result in "extirpation" ("catastrophes") as the USDA implied. If mortality may be "locally high," the RPAR criterion has been met. The remaining issue has to do with the weight assigned to the adverse effect in arriving at an appropriate regulatory posture. How rapidly a depressed population may recover could be used to indicate the extent of the impact. The fact that a population retains the capacity to recover, however, does not obviate the significance of the adverse impact in terms of the RPAR risk criteria.

Similarly, Respondent #4A stated, "We do not accept the premise that annual treatment of 0.01 percent of the grazing acreage for prairie dogs and 0.02 percent of the grazing acreage for ground squirrels constitutes a significant hazard to nontarget species" and "For example, significance of the deaths of eight Canada geese is questionable when one recognizes that in 1974 populations were estimated in excess of 3 million birds ...." Rapid recovery of decimated nontarget populations was also predicted by Respondent #15B. Similar comments were received in rebuttal to the PD 1, and the Agency addressed these comments in the PD 2/3.

The Agency conceded in the PD 2/3 that it could not assess the population significance of the reported mortality of eight geese and that the "significance" of mortality to mourning doves and other species would vary with the circumstances. Except for endangered species, the Agency did not suggest that nationwide populations could possibly be affected by the use of strychnine.

The Agency now has specific examples of how local populations of geese were affected by the use of strychnine in dyed bait to control ground squirrels in Montana. "The recent losses of Canada geese to strychnine poisoning may outwardly appear to be insignificant when compared to the overall Rocky Mountain goose population. These losses, however, are magnified when their effect is measured against the status of the breeding flock they represent. The loss of 17 geese near Ennis, Montana is a case in point. This loss represents one-half of the 1981 goose production from the Ennis survey area."(Respondent #79)

The Agency's discussion of the "significance" of wildlife kills should be viewed with reference to its responsibilities and proposed actions. For example, annual treatment of 0.03 percent of the grazing lands for prairie dogs and ground squirrels implies as trivial a benefit at the national level as it does a risk. The Agency's proposed regulatory action, after weighing the "significance" of the nontarget losses of birds, was to require the dyeing of grain bait, even though it had no firm basis for assessing the effectiveness of this procedure. It now seems clear that users cannot rely on the dye to prevent all nontarget bird mortality. Also, as indicated in PD 2/3, if users are generally incapable of using the bait in ways that prevent nontarget losses of concern, a consideration of further restrictions at the local, state or national level may become necessary.

The Agency has no mathematical model for assessing risks to wildlife. In general, however, species that are abundant and have a high reproductive potential are of less concern than are those that are rare and/or endangered and are less capable of recovering from population reductions. The statutory objective, however, is to develop a regulatory response that is consistent with the relationship between the risks and benefits of use. In the case of strychnine, proposed actions ranging from taking no action (indoor house mice) to cancellation (prairie dog) are appropriate responses, depending on the use. Many respondents apparently failed to understand this use by use balancing process, seemingly objecting to the need for <u>any</u> proposed regulatory action.

B. Extrapolation of Secondary Risks from Toxicological Data

The major point made by the Agency in its attempt to evaluate relative risks from secondary toxicity was said to have "... demonstrated a major flaw in toxicological reasoning. The discussion of LD_{50} leads to the conclusion that the author(s) lack a good understanding of the principles of pharmacokinetics and toxicology .... EPA assumes a 0.5 kg ground squirrel eating 2 gm of 0.5% strychnine (an LD_{50} dose) may have consumed just the lethal amount. This is faulty reasoning. They could just as well have said it would have been half-killed." (sic) Since an LD_{50} dose is that dose which will kill 50% of the treated animals, and the "median" animal will have received just a lethal dose, the Agency cannot comprehend the basis for the objection. Admittedly, a more complex set of assumptions and theoretical curves of consumption and residues might have been proposed.

The Agency noted in PD 2/3 that if a 1 kg prairie dog consumed the same amount of strychnine, as much as 8 mg of strychnine may remain in the gut because the LD_{50} for prairie dogs is only 1.5 mg/kg. USDA Exhibit C protested that "This is also incorrect reasoning. It ignores absorption, distribution, metabolism and excretion of strychnine entirely. It is not possible to use LD_{50} information to estimate absorption, which is what is done in this case. Clearly, conclusions based on this type of reasoning are not founded [sic]."

Assuredly, the Agency should have more clearly indicated that its scenario of comparative risks was not based on any actual measurements of residual strychnine and that the numbers employed were used mainly to enable the reader to visualize the relationships readily. The major point, however, is that there is likely to be a direct relationship between the number of lethal doses consumed by the target animals and the residues of unmetabolized strychnine. USDA Exhibit C has not specifically addressed this relationship. There has been no demonstration that secondary poisoning from strychnine cannot occur in the field or that the examples in the PD 2/3 are not valid, or that secondary risk is not related to the amounts of strychnine ingested (or pouched) by the target organisms.

While the Agency does share some of USDA's evident frustration over the state-of-the-art of risk assessment techniques, it noted that Ketron (1979) had independently employed procedures very similar to those used by the Agency in assessing risk. In the absence of better information, the Agency stands by its assessment of secondary poisoning.

C. Specifics on Endangered Species

1. Attwater's Greater Prairie Chicken

Respondent #4A stated, "...we disagree, based on extensive field experience, that strychnine baits present significant hazards to the Attwater's prairie chicken." This was the total comment received. It did not indicate either the nature of the experience, the kind of bait (grain vs fresh) or what is meant by "significant." Unfortunately, this comment does not provide information that would permit the Agency to reassess its position.

2. The Red Wolf

Respondent #4A indicated that the red wolf "...has in fact been declared extinct by the U.S. Fish and Wildlife Service." This statement is not entirely accurate since red wolves exist in captivity and the FWS has made no official statement regarding the status of wild populations. It appears, however, that if any red wolves remain in the wild they will inevitably be subjected to hybridization with the coyote. Therefore, the Agency concludes that no useful purpose would be served by prohibiting the rodenticidal uses of strychnine in counties formerly occupied by viable populations of red wolves. Should red wolves be released back into the wild in the future, any special needs for protection can then be instituted.

3. Aleutian Canada Goose

Respondents #14, #91, and #94 noted that in Glenn County, California, wintering Aleutian Canada Geese feed on rice, that there are no ground squirrels either in the rice fields or surrounding pasture and cropland, and that the squirrels that need to be controlled in areas occupied by geese are at very low densities in ditch banks, levees and canals. Rangeland and orchards where ground squirrels are controlled are not frequented by the geese. According to the respondents, it would be more appropriate to establish restrictions for ground squirrel control during the time period consistent with the arrival of these geese at their wintering area rather than the time frame proposed. To allow for September baiting for ground squirrels, a period of October 1 through April 30 for baiting prohibitions is appropriate since the geese usually arrive in November and December and do not remain past April 30.

The Agency agrees in principle that there is no need to prohibit the use of strychnine in areas not normally frequented by the goose if there is reasonable assurance that the geese will not be exposed either inadvertently because the geese alter their behavior or by lack of compliance with the guidelines. The situation in Glenn County appears to be favorable for relaxing the Agency's proposed decision because strychnine would not be used generally in ways that would expose the geese. Consultation with wildlife specialists prior to strychnine use could prevent accidental exposure if guidelines were developed.

4. San Joaquin Kit Fox

The Agency proposed prohibiting the use of strychnine for rodent control in those counties known to be inhabited by the San Joaquin kit fox. Respondents #13, #45, and #94 claimed that county-wide cancellations were unnecessary because strychnine baits would pose no risk to the kit fox if they were applied a mile or more from dens and sitings. Currently, the California Department of Fish and Game insists that no strychnine baits be used within one mile of an <u>active</u> (emphasis added) San Joaquin kit fox den (Respondent #57).

The Agency acknowledges that a buffer zone of a mile should adequately protect most kit foxes from strychnine. One question is how such a restriction can be implemented and enforced. The Agency is unaware of

active programs to locate all kit fox dens, and from past surveys (Morrell, 1975) it appears that there are large areas where the density of kit fox dens is about one per square mile. Obviously, in such areas, it may be impossible to find a site to treat that is a mile or more from a den. The Agency is also concerned that the conflict associated with the discovery of new dens in areas of low kit fox density would lead to a reduced probability of survival for the resident kit foxes. The proposal of a buffer zone may therefore not be entirely effective.

The Agency indicated that "Claims that the number of kit foxes is increasing rests on estimates so crude that little confidence can be placed on the suggested trend" (PD 2/3, p. 15). USDA Exhibit D believed that "The data and studies ... are much better than admitted by the author and the trend has existed for some 20 years." Since no citations or independent analyses were provided, the Agency cannot evaluate this comment.

It is possible that the current status of this kit fox is such that some low level of mortality related incidentally to rodent control is readily compensated for by enhanced survival of the residual population. A sound program of monitoring population trends would enable California to determine the level of concern and appropriate degree of regulation that should be applied to various rodenticides.

5. Black-footed ferret

While USDA Exhibit D questioned the Agency's observation that the present plight of the ferret "... is doubtlessly due to the fact that prairie dogs have been eliminated over the majority of the acreage previously occupied" (PD 2/3 p. 31, see also Ketron, 1979, p. 141), the point that factors such as disease, parasites, predators and loss of genetic variability are germane to current concerns is well taken. It may well be that coyotes were instrumental in the apparent disappearance of ferrets from Mollette County, SD, even as prairie dog numbers increased, as USDA Exhibit D and others suggest. However, such environmental pressures on local populations of ferrets emphasize the need to avoid poisoning ferrets in the course of controlling prairie dogs. Shaffer's (1981) analysis of minimum population sizes for species conservation and the role of demographic, environmental and genetic stochasticity (chance events) along with natural catastrophes is directly applicable to the plight of the ferret.

USDA Exhibit D (p. 10) suggested that the risk to the ferret can be quantified by considering that there may be 200 ferrets among the 4,000,000 acres inhabited by prairie dogs, that the probability of a ferret feeding on a strychnine-killed prairie dog is 0.5 and the probability of death from such a feeding is 0.5. The probability of killing a ferret by poisoning a typical 40-acre dog town was then erroneously calculated to be $1/(8 \times 10^9)$. The correct value is 1/2000, or 0.0005=(0.5 x 0.5 x 200 x 40/4,000,000). If 100,000 acres are treated annually, an average of 1.25 ferrets might be killed and such an added mortality rate (0.6%/year) would not likely be of major consequence to the survival of the ferret. Such an analysis does, however, support the RPAR trigger.

Although this approach to risk assessment seems logical, it does not put confidence limits on the assumption and estimate and does not consider the apparent highly dispersed character of the ferret population.

While there is a very limited data base on the behavorial responses of ferrets to a poisoning operation (Henderson, 1974), the Agency considers it reasonable to assume that, with a precipitous reduction in normal prey and an abundance of fresh dead or dying prarie dogs, any ferrets in a poisoned town are likely to feed on several strychnine-killed animals before dispersing. Again, while there are no data on the level of strychnine to which a ferret might be exposed from feeding on a prairie dog, from reports of other carnivore mortality associated with ground squirrel control (PD 2/3) it seems highly probable that lethal exposure to strychnine can be anticipated. Adding to these considerations the increased risk of a ferret searching for a new home, the Agency believes that the probability of death for a ferret exposed to a control operation using strychnine is much closer to unity than it is to the 0.25 level suggested above. This would bring the odds of killing a ferret by treating a 40 acre town up from 1/2000 to near 1/500 and annual mortality would be 2.5% instead of 0.6%. For any particular dog town, however, the risk to the ferret is either nil (none present) to near unity.

The current distribution of the ferret is unknown but it is likely that its occurrence can be described as occupying an unknown number of "islands," substantially isolated from each other by distance and with minimal genetic exchange among the local populations. Local populations probably vary in viability and capacity to expand. Some local populations may become extinct even if no prairie dog control is practiced. The major jeopardy to the continued existence of the ferret comes not from an added mortality of a small percentage spread evenly over all populations, but from the possibility that the mortality will inadvertently fall heavily on one or more local populations. If the effect is not immediate extinction, such localized impacts could produce dispersion beyond that required for successful reproduction. Each loss of a local population further reduces both existing genetic diversity and the likelihood that the ferret can be saved. The odds on local extinctions probably vary substantially with the dispersion of dog towns and strategies for their management. The Agency has no basis for believing that the current level of prairie dog control -- 100,000 acres/year -- either is now or will be uniformly distributed among the 4,000,000 acres of dog towns. The assumption that mere chance will guarantee the continued existence of the ferret when exposed to strychnine used for prairie dog control is not persuasive.

Some Respondents (#4A, #16 and #17) indicated that there are relatively wide areas over which there have been no verified ferret sightings for many years. They questioned the logic of prohibiting the use of a toxicant to protect a species that does not exist.

Recent verified records (Nice, 1982) indicated that the ferret is certainly not extinct; it is probably very rare in some regions, and it may well be absent from wide areas. It may be more common than the records show because landowners do not want the attention that a report might attract. Whatever the local circumstances, the status of the ferret appears to be so precarious that potential losses from the use of pesticides must be viewed with great concern.

One proposed remedy was to conduct a search to determine if ferrets are present (Respondents #4A, #31, #32, #71, and #81, and the USDA). The respondents did not indicate either how such searches should be conducted or their reliability. The USDA relied on Ketron in stating, "... all risks to black-footed ferrets from oat bait applications in prairie dog towns could be eliminated by conducting surveys prior to application." Ketron (p. 140), however, indicated that "... a town would have probably had to be monitored for three or four nights before the absence of ferrets could be reasonably assumed ...," and "The US Fish and Wildlife Service search has developed improved methods of ferret detection. Dogs were trained to locate ferrets by scent.... Using these methods in a well conducted pre-control survey should make it possible to establish if there are any black-footed ferrets in a prairie dog town before control measures are instituted." Neither the USDA nor Ketron estimated how many trained dogs it would take to survey the 100,000 acres of praries dog towns that are treated annually. Neither was the cost of conducting adequate searches given consideration. While such a procedure may seem attractive as an administrative expedient, the Agency has little basis for evaluating the associated costs and benefits. Moreover, the FWS has stated (Personal communication, August 3, 1983) that they "...cannot, within the bounds of practicality, make a determination that ferrets are <u>not</u> present in a given dog town with an acceptable degree of probability."

The Agency is aware of two ferret discoveries in 1981. A ferret was uncovered while moving a haycock in South Dakota and one was brought in dead by a dog in Wyoming. The latter event led to the discovery of additional living animals (Nice, 1982). Comparing relatively recent findings, including skulls, with the historical record indicates that the past is not an adequate predictor of the present. Most recent specimens have been found in counties where there was no prior record. Exploratory searches by the Fish and Wildlife Service in recent years have failed to produce live animals. Thus, the Agency has no basis for believing that, through searches, the ferret can reliably be declared extinct over large regions in its historical range.

Some respondents indicated that the ferret is not a "carrion eater" (Respondent #16) and is unlikely to feed on stomach contents (Respondents #32 and #34) of strychnine-killed prairie dogs. The anecdotal data base for these assertions are inadequate to conclude that no risk exists. Surely, at the time of a control operation, there are many animals either in the process of dying (and thus easy prey) or at least still warm, and it is unreasonable to believe that such animals are not perfectly acceptable when exposed to any predator. This position is supported by Henderson's (1974) review of available observations.

Again, in the absence of much meaningful data on ferrets, the Agency expected that a stomach stuffed with herbage is unlikely to be consumed by a ferret. The Agency cannot concede that a stomach containing only a few grams of chewed-up strychnine oats is similarly unpalatable for a ferret or any other carnivore. While the Agency knows of no confirmed ferret mortality caused by strychnine (Respondent #71), it must be noted that, even if 90 perceent of all ferret mortality during the past 25 years had been due to poisoning operations, the chances of confirmation would

have been extremely remote. Unfortunately, one cannot diagnose most causes of death from weathered skeletal material. The above comments did not rebut the Agency's conclusion regarding risks to the ferret from the use of strychnine for prairie dog control.

Ketron, calculated that "... the LD_{50} of the black-footed ferret would have to be less than 8 mg/kg for it to ingest a midlethal dose by eating the gastrointestinal tract of a prairie dog (killed by strychnine oats)." While Ketron was unable to put this value in perspective because the only LD_{50} for carnivores available to them was for canids, unpublished data (in PD 2/3 Table III-1) suggests that cats similarly have LD_{50}'s on the order of 1 mg/kg. It would be unwise to predicate a risk assessment on the assumption that the LD_{50} for the ferret is substantially larger than that for the other carnivores even though it belongs to a different family. Where specific data are lacking, an ample margin of safety must be applied to protect endangered species.

Respondents #14 and #31 indicated that the use of fumigants to control prairie dogs probably provided the greatest risk to the black-footed ferret. The Agency is also concerned with this problem but will not address it in this document.

6. The California Condor

USDA Exhibit D and Respondent #94 noted that because the State of California currently prohibits the use of strychnine for controlling ground squirrels within the range of this condor and because the normal distribution of the condor is known, countywide prohibitions are unnecessary to protect this species. The latter point was also made by the Agency's Scientific Advisory Panel (SAP).

The Agency agrees that prohibiting the use of strychnine for ground squirrel control in the range of the condor by the state would obviate the need for imposing county-wide prohibitions by the Agency. The difficulty the Agency has with California's Joint Policy Statement (USDA Exhibit G) is that guidelines for protecting species are not formalized and are subject to change without public review.

7. Other Species

USDA Exhibit D (p. 11) noted that the Agency's position on the peregrine falcon and the Aleutian Canada goose did not agree with the USDI biological opinion (USDI, 1979) and claimed that "It is inappropriate for the EPA, which is lacking in wildlife knowledge and expertise, to take such a position." While the Agency has high respect for the opinions of the USDI, it it under no legal restrictions to rely solely on their opinion in meeting its statutory responsibilities in regulating pesticides. In addition to the Biological Opinion, the Agency has consulted with numerous appropriate federal, state, and academic biologists before formulating its position on the falcon and the goose as well as other endangered species of concern. Additionally, facts such as the poisoning of two peregrine falcons by use of strychnine to control pigeons in Baltimore were not available at the time of the USDI's review.

D. Risk Reduction Methods

1. Use of dyed baits

Several Respondents (#4A, #36, #63, #69, #72, #79, #81, and #94) disagreed with the Agency's evaluation of the risk-reduction benefits from the use of dyed bait for rodent control, indicating that the Agency had not cited all relevant literature. Since the Agency proposed that all grain bait used for above-ground rodent control be dyed, the discussion appears moot. Nevertheless, some points need clarification and emphasis.

The Agency concluded that, while there was some experimental evidence that the use of dye on strychnine-treated grain might serve to inhibit certain species of birds from feeding on the grain, there was no valid information that would permit a prediction of the degree of risk reduction associated with this practice. While the Agency could not conclude that the effect would generally be substantial, requiring the use of dyes was considered desirable because some benefits were possible and the cost was negligible. Information from the above respondents provides no basis for altering that position. Subsequent information received from Respondent #79, however, makes it clear that this position may not be entirely tenable.

During 1981, officials in Montana (Respondent #79) became aware of several cases where geese and other birds were poisoned in association with the use of strychnine grain to control ground squirrels. Some of the operators indicated that the dye in the bait was supposed to prevent such nontarget mortality. These episodes reinforce the uncertainty regarding the usefulness of dyes and, to the extent that the presence of dye in the bait encourages users to treat areas where nontarget animals are highly exposed, the presence of the dye may serve to increase risks.

Ketron (p. 71) stated, "As has been emphasized throughout this discussion, the risk to seed-eating birds from dyed strychnine oat baits is not known." This independent assessment on behalf of the USDA/APHIS is consistent with the Agency's position.

2. Bait concentrations: birds

To reduce risks, the Agency proposed that all formulations of strychnine for controlling depredating bird damage be standardized to conform with the lowest registered label — 0.20% (Fresno County for blackbirds). Respondents (#4A, #13, #45, #61, #72, #83, #86, #88, #90, #91, #93, and #94) defended those concentrations currently recommended in California's Vertebrate Pest Control Handbook (Clark, 1975), specifically 0.3% for house sparrows and crowned sparrows, 0.35% for blackbirds and cowbirds, 0.43% for linnets and 0.65% for horned larks. They argued that these formulations had been developed from several years of research beginning in 1929 and had continued to be found efficacious with little or no nontarget risks. The reasons for the range in concentrations include:

1. Larger birds need a higher concentration for control (e.g., house sparrow vs. linnet and horned lark)(Respondent #45).

2. Species differ in their feeding behavior (Respondent #45).

3. The horned lark and linnet are more belligerent when feeding than is the house sparrow and a stronger concentration of strychnine is necessary because individuals of these species will spend less time at the feeding tray (Respondent #13).

4. Bait type: Whole grain with hulls requires a higher concentration than does hulled bait (e.g., rape or canary grass seed for linnets vs. hulled seed baits for sparrows)(Respondent #61, pp. 34-35).

In response:

1. The Agency is unaware of any consistent relationship between body size and concentration of toxicant needed in bait and such relationships are not demonstrated by California's Handbook. Horned larks (0.65% strychnine) are smaller than blackbirds (0.35% strychnine).

2. Certainly there are interspecific differences in feeding behavior among birds but these differences are normally adjusted for by the type of bait and its placement.

3. The Agency acknowledges that linnets are generally more aggressive at feeding stations than are house sparrows and that this factor could require a higher concentration of strychnine to compensate for a shorter feeding time. The Agency has no data to evaluate this hypothesis, however. Since horned larks are baited in fields by spreading the grain lightly in prebaited rows it is not obvious that aggressive behavior by the larks will necessarily have an adverse affect on their consumption of bait. Again, the Agency has no data for assessing the validity of this argument.

4. The Agency agrees with the logic that a bait that is hulled by the target organism before being consumed may require a higher concentration of toxicant than does a bait that is swallowed whole. The Agency notes, however, that recommended baits for various target birds include both whole and hullable baits and that the concentration of strychnine recommended does not change with the variable. For instance, baits recommended for horned larks include steel cut grains, whole or cracked groats, cracked milo, cracked corn, lettuce seed, or canary grass seed (Clark, 1975). If the argument is valid, it would appear that the concentration of strychnine on some of these baits could be reduced substantially without altering efficacy.

3. Bait concentration: Rodents and lagomorphs

Reasoning that secondary risks from strychnine were likely a consequence of overformulating and overbaiting, the Agency proposed standardizing the concentrations of strychnine in various products, relying on the assumption that the registered product with the lowest concentration would be efficacious. Specifically, the Agency proposed 0.2% for ground squirrels, 0.28% on grain bait or 0.1% on green bait for jackrabbits, and 0.16% for kangaroo rats and cotton rats.

The FIFRA Scientific Advisory Panel's recommendation was that the EPA reconsider establishing these levels based on "evidence now available and to be submitted during the comment period."

A variety of objections and counterproposals regarding the 0.20% proposal for ground squirrels were submitted by respondents:

1. Efficacy will be reduced (Respondents #37, #46, #49, and #94)

2. Bait shyness will develop (Respondents #15, #37, #49, and #94)

3. Different kinds of ground squirrels require different concentrations for equal efficacy (Respondents #31A , #61, #64, #73, #88, and #94)

4. Required concentrations vary with locality and other variables (Respondents #43, #61, and #94)

5. Primary hazards to birds would increase because the Agency's proposed use of 0.20% utilized a dose of one tablespoon of bait per burrow instead of the usual teaspoon of 0.50% bait. This would leave much bait unconsumed by the target animals (Respondents #16, #31A, and #43).

6. Additional testing is necessary to be sure of adequate efficacy (Respondents #31A, #34, #88, and #94)

7. For California ground squirrels, 0.29% is adequate (Respondent #61 and #94); for Richardson's and 13-lined ground squirrels, 0.35% is appropriate (Respondent #16 and #88)

Although in some cases there was either an indication or an implication that data or other information was available, only one respondent (Respondent #31A) actually submitted new data. This substantive contribution will be discussed separately from the following general discussion.

Generally, the Agency has no factual basis for evaluating many of the opinions expressed by most respondents. The Agency agreed in principle that there are many variables potentially influencing the optimal concentration of toxicant (Respondent #61) but questions whether, in fact, the state-of-the-art in ground squirrel control adequately employs those principles. Higher concentrations of strychnine are not necessarily more efficacious and, where operators have some control over the timing of baiting relative to weather, competing food supplies and other factors influencing success, maintaining high-concentration formulations to overcome such adverse conditions is not essential. Considering the fact that the several species of ground squirrels that are of major concern tend to have large and non-overlapping geographical distributions, the Agency disagrees with Respondent #61's suggestion that baits should be formulated at a concentration suitable for the most resistant species. Just as California currently recommends at least four different concentrations of strychnine for bird control it is logical to assume that different concentrations would be needed to control different species of rodents.

Recent tests conducted in Montana (Respondent #31A) contribute substantially to an evaluation of the Agency's proposed use of 0.20%

strychnine for ground squirrel control. A reference used by Respondent #31A (Sullins, 1981) reported the following population reductions of Richardson's ground squirrels using various replicated concentrations of strychnine in slightly crimped whole oats.

Strychnine %	Dose/Burrow	% Kill
0.20	1 tablespoon	84, 86
0.20	1 teaspoon	85, 86
0.35	1 teaspoon	66, 74
0.50	1 teaspoon	79, 80

At 0.20%, there was no difference in the kill related to quantity of bait. Since the tablespoon dose left much more bait unconsumed by the squirrels and thus available to nontarget organisms, the risk of using the larger quantity clearly exceeds the benefits. While the performance of 0.20% bait appeared to be somewhat superior to both 0.35 and 0.50%, a direct comparison was said to be inappropriate because larger amounts of green vegetation on the plots utilizing the higher concentrations might have interfered with bait consumption. While this interpretation may be correct, there is nothing in this study that would predict greater efficacy for the higher concentrations. The Agency again makes the point that baiting under adverse conditions (as recognized by the author) is not a circumstance to be generally accepted in rodent control operations and higher concentrations of toxicant will not necessarily overcome such conditions. Certainly additional testing would be required before one could be assured that the performance of 0.20% strychnine would generally equal that of higher concentrations, but these results are consistent with the Agency's belief that strychnine baits for ground squirrels are overformulated.

Tests were also conducted on the Columbian ground squirrel comparing the performance of zinc phosphide (2%) and strychnine (0.5%) following prebaiting (Respondent #31A, reference Sullivan and Baril, 1981). Control with zinc averaged 92.7% while that with strychnine averaged 73.6%. This contrasts with a 1979 study submitted by Respondent #31A (Albert and Record, 1979) in which, without prebaiting, respective control averaged 41.5 and 64.8%. Even with prebaiting, 0.5% strychnine does not appear to be an effective bait for Columbian ground squirrels. Whether, in fact, a lower concentration of strychnine would be more efficacious is a matter for speculation. In the absence of recent test data, the Agency's proposal to use 0.2% strychnine for all ground squirrels seems no more defensible than is the contention of those who claim that 0.50% is substantially superior.

California proposed to standardize strychnine formulations for ground squirrels at 0.29% (Respondent #61 and #94), presumably based on data which the Agency has not received. Montana's counterproposal of 0.35% strychnine was likewise not susceptible to evaluation except for the latest test.

4. Ground squirrel control in prairie dog towns. (Buffer zones)

In PD 2/3, the Agency proposed restricting the use for ground squirrel control to distances greater than one mile from active prairie dog burrows.

The purpose was to prevent exposure to black-footed ferrets, especially where squirrels are associated with white-tailed prairie dogs.

Respondent #16 noted that it is impossible to know the location of every prairie dog colony and that compliance with the restriction would require an extensive effort. Respondents #31 and #31A noted that the restriction is not enforceable and may preclude most control efforts aimed at Richardson's ground squirrel.

A suggested alternative to the 1-mile buffer was to use a buffer of 100-200 yards during the spring and early summer when most ferret activity would be devoted to caring for young and likely be confined to the immediate vicinity of a town. Since young ferrets disperse during the late summer and fall and this is generally a poor time to attempt control of ground squirrels, a 1-mile buffer might then be more appropriate (Respondent #39).

The Agency agreed with the logic of this counterproposal. While it is directed specifically at the black-tailed prairie dog/ground squirrel situation, it does not address the Agency's major concern that close associations between white-tailed prairie dogs and ground squirrels are more common (Campbell and Clark, 1981).

E. Risks of Alternative Pesticides

Respondent #31A noted that "...zinc phosphide overall will present a greater hazard of primary poisoning to water fowl, gallinaceous and other birds... The accidental poisoning of 455 geese in California was attributed to zinc phosphide that had been applied three months earlier (Keith and O'Neill, 1964)."

The Agency considered this problem in its comparative risk assessment (PD 2/3) and concluded that risks to gallinaceous birds would increase by substituting zinc phosphide for strychnine but had no basis for concluding that risks to other avian species would be predictably altered. Undesirable persistence of toxic baits was also noted but, again, the Agency has no sound basis for predicting conditions under which one toxicant may vary significantly from another in the ability to kill nontarget organisms weeks or months after application.

One can reasonably conclude that the geese recently killed by strychnine in Montana (Respondent #79) would likely have died had the operators been using zinc phosphide. Had compound 1080 been used, perhaps the effects would have been reduced. The point is that there are circumstances when operator judgment is required to avoid excessive exposure to wildlife and certified applicators should be aware of the risks. The traditional use of feeding areas by migratory waterfowl should be known to local applicators. These birds are protected by Federal laws. Nonmigratory, gallinaceous birds, generally protected by state laws, may also aggregate seasonally and proper precautions are necessary to avoid excessive exposure. The Agency is not aware that any species of gallinaceous birds is likely to congregate on prairie dog towns in the late summer and fall when bait is normally applied. In proposing to cancel the use of strychnine for controlling prairie dogs, the Agency believed that the need to protect the black-footed ferret outweighed any increase in risk to gallinaceous

birds from zinc phosphide. For example, zinc phosphide should not be used on traditional booming grounds for prairie chickens in the late winter and spring. Concerned states should educate their certified applicators concerning such risks that the Agency can address only in a general way by label warnings. Since current zinc phosphide labels for prairie dogs prohibit use from January through June, springtime aggregations of birds are now protected by this restriction.

III. COMMENTS ON THE AGENCY'S BENEFIT ANALYSIS

A. Introduction

The Agency faced severe data limitations in its analysis of the potential economic consequences of cancelling the above-ground, outdoor uses of strychnine. Due to the lack of sufficient usage or comparative efficacy data, it was often necessary to predict economic impact soley in qualitative terms. Even where it was possible to make quantitative economic evaluations, they represent rough predictions of strychnine bait distribution and economic impact.

The purpose of this chapter is to review and evaluate comments submitted to the Agency in response to PD 2/3 and to revise, as appropriate, the determination of benefits used to reach the risk/benefit decisions on the above-ground uses of strychnine.

Comments were reviewed for presentation of data that might alter or more accurately reflect the benefits of using strychnine than were determined in the PD 2/3. Those comments or arguments which lacked supporting data were also considered and, as appropriate, included in the reconciliation of differing points of view. Comments were also reviewed for biological and/or economic considerations not recognized during the preparation of the risk/benefit assessment on strychnine uses.

The Agency's Preliminary Benefit Analysis (PBA)[2/] evaluated methods of control which could be used if strychnine were cancelled and estimated the resulting economic effects if these methods were adopted. The PBA identified chemical and nonchemical methods of control and estimated the economic impacts based on the adoption of the methods most likely to be used for controlling the particular pest on a site-by-site basis (where data permitted). The benefit analysis did not suggest that strychnine should be eliminated in favor of any other control method, but rather evaluated methods which were most likely to be used in lieu of the use of strychnine.

B. Analysis of Comments

The Agency has received numerous comments regarding the viability, efficacy and cost of alternate methods of controlling ground squirrels, prairie dogs and other vertebrate pests. The vast majority of these comments generally opposed the Agency's proposed decisions. While many comments addressed relevant issues and offered a variety of arguments in support of their views, few supported their views with new information and/or data for specific uses of strychnine in a manner to make them persuasive. Without supporting evidence or data, the Agency could not assess the validity of the arguments on a site/pest basis. Apparently the data bases necessary to permit such evaluations were not available. USDA comments correctly pointed out that there is a "basic lack of data on the uses of rodenticides in the U.S., including quantity and location of use". The Agency is in full agreement with these comments and believes

2/ Prepared under contract by Development Planning and Research Associates, Manhattan, KS.

that additional relevant data on substantive issues are not available in comprehensive form.

The Agency is aware of the problems inherent in estimating benefits of specific vertebrate pest control methods given the myriad of factors that affect the success of these operations. The level of success depends on edaphic, climatic and topographic factors, species differences, operator skill levels, available alternatives and other factors that vary by species, location and over time. However, the RPAR process is an open process. Interested parties were encouraged to provide data and general information to the Agency so that the benefits and risks associated with each use of strychnine could be properly compared. As a basis for rigorous economic analysis, the comments received in response to PD 2/3 were often insufficient and incomplete. Consequently, the Agency was unable to make revised quantitative estimates of economic effects on any of the site/pest uses of strychnine.

The following sections discuss substantive comments organized by major topic or issue and present the Agency's conclusions regarding benefits based on these comments.

1. Ground Squirrels

For control of ground squirrels, the Agency proposed in PD 2/3 that these uses of strychnine should be retained providing certain modifications to the terms and conditions of use are made. The Agency noted the lack of viable alternatives and the potential economic impacts as major factors in determining the benefits of strychnine use.

Respondents generally believed that the Agency underestimated economic effects, but did not provide any data or information in comments that alter the Agency's risk/benefit decisions on this use of strychnine. Because the Agency has not proposed cancellation of strychnine use for ground squirrel control, the arguments offered in comments regarding the severity of the economic effects of cancellation, further support the Agency's risk/benefit decision.

2. Prairie Dogs

For prairie dog control, the Agency proposed cancellation of strychnine use. The Agency concluded that zinc phosphide, the alternative most likely to be used if strychnine is cancelled, is of approximately equal efficacy and cost. Furthermore, zinc phosphide can be used effectively while presenting fewer environmental hazards in prairie dog towns than strychnine. Other alternatives (i.e. 1080, fumigants, etc.) were also considered, and as appropriate, included in the consideration of economic effects.

The Agency received numerous comments regarding this proposed decision. The main economic concerns were control costs and efficacy of zinc phosphide. Respondents argued that zinc phosphide, due to higher cost and erratic control, is not a practical alternative as compared with strychnine. Although respondents generally disagreed with the Agency's characterization of economic effects, few provided data or

information which would support rigorous economic analysis to enable the Agency to more precisely quantify the benefits of strychnine use for prairie dog control. The following sections discuss substantive comments regarding efficacy and control costs of using zinc phosphide.

a. Efficacy

Considerable concern has been expressed by respondents, including USDA and the SAP, regarding the efficacy of zinc phosphide as an alternative to strychnine for prairie dog control.

In response to these comments, the Agency contacted a variety of Federal, state and local vertebrate pest control specialists and other personnel who were experienced and knowledgeable regarding the control of vertebrate pests with zinc phosphide. As a result of these contacts and the careful evaluation of PD 2/3 comments, the Agency believes that zinc phosphide is a viable alternative to strychnine for this use.

In estimating the benefits of strychnine use for prairie dog control in the PBA, the efficacy of strychnine and it's alternatives was evaluated. The Agency recognized the uncertainties involved with estimates of the effectiveness of rodenticides. The reported efficacy of both strychnine and zinc phosphide are highly variable (i.e., reported efficacy ranges between 30-100 percent). Strychnine was considered only fairly effective in controlling prairie dogs due to bait shyness. The PBA noted that strychnine's effectiveness could be increased by prebaiting. Prebaiting is necessary when using zinc phosphide and PD 2/3 comments generally agreed with this assessment (e.g., Respondents #29, #31, and #32). Without prebaiting, the PBA noted that the efficacy of zinc phosphide is unsatisfactory. The conclusion of this efficacy review was that under normal use conditions, the expected efficacy of both zinc phosphide (with prebaiting) and strychnine were about equal.

The Agency agrees with USDA and other respondents that many factors affect the success of "control" operations. The Agency agrees with USDA comments that alternatives should be evaluated in terms of their use patterns on a site and pest basis. Further, the Agency agrees with USDA comments that target species and subspecies are often differentially susceptible to the same control material and that any discussion of alternatives must include the usefulness of those materials for various target species. Comments indicated that user experience with zinc phosphide in some areas was "poor" while users in other areas have reported "highly effective" results. Factors such as local weather conditions, user expertise and proper baiting procedures apparently contribute to the level of success when using zinc phosphide.

Finally, the U.S. Fish and Wildlife Service (FWS) was consulted regarding the usage of zinc phosphide to control prairie dogs. The FWS indicated that it "does not use or recommend the use of strychnine to control prairie dogs in the historic range of the black-footed ferret, therefore we do not oppose the cancellation" (USDI, 1983). Furthermore, as stated in the FWS Biological Opinion, "It will be Service policy to substitute the use of zinc phosphide for strychnine (where allowed by registration) in prairie dog control" (USDI, 1979).

In conclusion, the Agency believes that if properly used, zinc phosphide is effective in controlling prairie dogs although the actual efficacy can vary from place to place.

b. Treatment Costs

Several respondents provided both a wide range of general and specific comments regarding issues which relate directly or indirectly to the control costs of using strychnine and alternatives. Examples of general comments follow:

Respondent #10 believed the proposed action would "put many operators out of business." Respondent #12 noted strychnine is the only reasonably effective control method and that other methods of control are unavailable or too expensive or ineffective to be practical. Other products are not effective or their cost is prohibitive (Respondent #17) and a "considerable amount of loss would occur if strychinine is cancelled" (Respondent #27). Respondent #28 blamed "Agency restrictions" for the tremendous increase in the cost of strychnine. Respondent #29 indicated that zinc phosphide must be prebaited to be of value, and high fuel and labor costs and time availability limit its practicality for field uses. Respondent #31 agreed with this view also noting that considering the time and cost of prebaiting, use of zinc phosphide is not economical and that the economic importance of rodent pests "cannot be understated."

Examples of more specific responses included Respondent #32 who noted "zinc phosphide gets such a poor kill that it would increase the cost greatly." This respondent also provided detailed comparisons of zinc phosphide and strychnine treatment costs. Treatment costs (material and labor) with strychnine were estimated by Respondent #32 to be about $1.60 per acre treatment with a follow-up with gas cartridges costing $1.80 per acre for a total of $2.40 per acre. The Agency estimated strychnine treatment costs (including prebait, material, labor and mileage) of $2.64 per acre excluding the follow-up with gas cartridges. This respondent estimated treatment costs (material and labor) with zinc phosphide at $6.10 per acre. This estimate was based on three annual applications of zinc phosphide bait (two applications at $1.15 per acre and one at $0.65 per acre) plus $0.45 per acre for prebait and $2.70 for follow-up with gas cartridges. This same respondent indicated rancher applied bait could cost about $1.60 per acre application.

In addition to the information submitted in response to PD 2/3, the Agency also made additional inquiry with several respondents to clarify or gather further information concerning their comments. As the result of these inquiries, respondents provided the Agency with additional sources of information regarding treatment costs with strychnine and alternatives. One such contact, Frontier Pest Control, (a firm specializing in field rodent control in Montana, Wyoming and Eastern Washington) provided the Agency with contract rates for prairie dog control with strychnine. Frontier's quoted 1981 prices for strychnine bait application ranged from $2.85 to $3.30 per acre depending on method and rate of application. Optional prebaiting could add an additional $2.00 per acre. According to Frontier, total costs for custom applied strychnine bait could range from $2.85 to $5.30 per acre without and with prebait, respectively. Frontier

estimated that zinc phosphide treatments would cost $3.25 to $3.50 per acre plus prebait for a total of $5.25 to $5.50 per acre.

The USDA and Respondent #78 commented on the cost of prairie dog control and cited estimates indicating that zinc phosphide is more expensive than indicated in the PBA. USDA cited their own Forest Service estimate that the cost of treating with zinc phosphide is $7.00 an acre. The USDA also believed that EPA had underestimated that need for pest control both qualitatively and quantitatively, citing the USDA-FS proposed management plan for prairie dog control on lands administered by USDA.

In response to these comments, the Agency collected the annual reports of the Prairie Dog Control Programs conducted since 1978 on USDA's Nebraska National Forest (NNF). USDA used zinc phosphide in these control operations and concluded that zinc phosphide consistently produced moderate to high level (>80 percent) kills. Further, comparing treated and untreated activity levels based on transect survey techniques, USDA reported "a 93 percent kill success."

In reviewing the actual USDA program costs of prairie dog control conducted on the Fall River Ranger District (NNF) during 1980, total costs for use of zinc phosphide were $6.48 per acre treated. These costs included applicator training, inventory of towns, 1980 management plan preparation, ferret surveys, project preparation, installing and reading transects and report preparation. Labor costs averaged $7.87 per hour which was about $4.77 per hour more than the average prevailing labor rates for livestock workers in the surrounding states.

Subtracting direct administrative personnel charges and using USDA costs for supplies and vehicle expenses, treatment costs for zinc phosphide applied by hand by a private land owner were approximated to range between $3.06 and $4.80 per acre when wage rates are $3.00 and $6.00 per hour, respectively. These estimates would be representative of private land owner applied zinc phosphide bait costs and compare closely with Frontier Pest Control contract rates.

Similarly, data from the 1980 USDA-FS Prairie Dog Control Program on the Wall Ranger District (NNF) were used to evaluate zinc phosphide application costs using motorized equipment. These costs were estimated to range between $2.24 and $3.19 per acre when wage rates are $3.00 and $6.00 per hour, respectively (excluding administrative costs).

These estimates show that treatment costs for hand applied methods are more sensitive to labor rates than are mechanical application techniques. Even at labor rates of $6.00 per hour, which are nearly double the average hourly rate of livestock workers in surrounding states, the per acre costs are $4.50 for zinc phosphide applied by hand on foot and $3.19 per acre for zinc phosphide applied via motorized vehicles. Both estimates are well below the $7.00 per acre estimated by USDA and respondent #78.

In 1981, the USDA prairie dog control project shifted emphasis from reliance on Forest Service employees for control work to a primary reliance on control via contract. In 1981, the average cost of USDA's zinc phosphide control program on the Wall Ranger District was $4.12 per acre (USDA, 1982).

Comments demonstrate that the overall costs of treating with either zinc phosphide or strychnine are highly variable. Based on comments submitted to the Agency, treatment costs with zinc phosphide could be about $0.45 to $3.70 per acre more expensive than strychnine where prebait and follow-up treatments are not required with strychnine. Using the higher figure and assuming that these higher costs apply to the entire 110,275 acres estimated to have been treated (1977-78 year basis) with strychnine for prairie dog control, treatment costs with zinc phosphide for prairie dog control could exceed strychnine costs by $408,000. Further, retreatments may be required more frequently than with strychnine and assuming that an additional regime of zinc phosphide treatments (previously noted from Respondent #32 as 3 treatments with zinc phosphide preceeded by prebait and followed up by gas cartridges), costing $6.10 per acre are needed, costs could approximate an additional $672,700. Thus, using these assumptions, the total additional costs of treating prairie dogs with zinc phosphide could approximate slightly more than $1 million (408,000 + $672,700 = $1,080,700).

Data provided in comments were insufficient to evaluate the extent that these assumptions apply to acres currently treated with strychnine. However, the Agency doubts that the entire acreage treated with strychnine would receive three annual treatments with zinc phosphide preceeded by prebait and followed up by gas cartridges. This would mean that each acre would have to be "gone over" five times annually. The probability of this scenario occuring on the acres treated with strychnine is unknown but the likelinood is low. Further, the Agency believes that three annual treatments with zinc phosphide (or even strychnine) would lead to problems of bait shyness and would not prove feasible.

3. Market Depression and General Economic Impact

Several respondents (USDA, #15, #39, #51A, #71A, and #73) protested that the proposed actions would have more serious consequences than noted by the Agency's proposed decision or that Agency actions would increase crop and livestock prices.

Respondent #51A provided comments on the PBA, arguing that the Agency underestimated the impact on the cattle industry. This respondent calculated that the "real added cost for strychnine substitutes could be in the area of $6,491,000 to $9,127,160 (an increase of costs of 8,154% and 11,466%, respectively)." In separate calculations, this respondent estimated the cost of "substituting for strychnine" in the "17 western states" of $36.9 million stating that these costs are 46 times the impacts in the PBA.

The Agency has received data and reviewed other information that suggests that substitutes for strychnine are available and effective but would not increase treatment costs by this magnitude.

Respondent #51A also commented on the ability of individual ranchers to pass along increased costs to consumers. They stated that in a competitive industry such as the cattle industry, all cost increases or decreases are passed along to consumers in the form of higher or lower prices. In contrast to increases in production costs to whole industries, individuals are unable to pass along increases in production costs. Individuals, in this case

ranchers, are subject to market prices at the time their livestock is sold, regardless of factors which affect their personal production costs. The Agency believes that in the case of strychnine, individuals within the industry will be affected and they will be unable to pass along any increases in production costs to consumers.

In evaluating the risk/benefit decisions of strychnine, the Agency found that strychnine use was not universal in the livestock industry, but that only a relatively minute acreage of U.S. grazing land was treated in any given year. This implies that the impacts would be unevenly dispersed among individuals rather than evenly dispersed throughout the industry as a whole. The Agency has not received any data that suggests these conclusions are inaccurate. Further, the Agency has proposed cancellation actions on only about one-third the area currently treated with strychnine.

USDA's comments asserted that crop prices will rise if strychnine is cancelled (PSS Associates) due to productivity declines in "crops" as a result of inferior alternatives.

As previously discussed, even while strychnine has been available, USDA-FWS has used zinc phosphide for at least three years to control prairie dogs on USDA administered lands and reported "highly effective" results. Thus, USDA's own data contradicts this logic that "any substitute is inferior" and the contention, based on this logic, that cancellation will lead to higher "crop" prices.

USDA stated that "EPA underestimated the need for pest damage control, both qualitatively and quantitatively." The Agency finds this statement in error as the available literature on "pest damage" pertaining to the various site/pest combinations that were summarized in the PBA. Furthermore, the Agency guidelines for content of economic impact analyses do not require an analysis of the "need for pest damage control" in risk/benefit assessments (See Federal Register, Vol. 41, No. 102, May 25, 1976, pp. 21402-21405.)

USDA has also commented that EPA did not analyze the impacts on small business entities and cited the impact on two small pesticide manufacturers as examples of these impacts which were overlooked by the Agency. In the Federal Register, Vol. 41, No. 102, May 25, 1976, it was specifically noted that impacts on pesticide manufacturers are not germane to this type of decision where risks from the use of a pesticide are compared to benefits of its use. Thus, USDA comments regarding the impacts on small entities (citing two pesticide manufacturers) are not relevant.

4. Soil Erosion

Several respondents indicated a concern that without control, farmers and ranchers would have a steady invasion of prairie dogs onto their holdings and "lose" their soil to wind and soil erosion. With no control this might be a problem, but there is no reason to expect that soil loss by erosion will increase as the result of the cancellation of strychnine if former strychnine users continue to control prairie dogs by other available, effective procedures.

5. Other Rodents and Lagomorphs

No estimates of economic impact of the cancellation of strychnine registrations for these uses on all sites was made due to a lack of data. The Agency anticipates that there would be little or no national impact, however, if strychnine is cancelled for these uses because they account for a very low percentage of the total rangeland/pasture, cropland and nonagricultural site use.

IV. COMMENTS ON PROPOSED ACTIONS

A. Proposed Cancellations

1. Elimination of Control

A large number of responses (#6, #7, #9, #10, #13, #15, #16, #17, #27, #28, #29, #36, #37, #38, #39, #43, #46, #47, #48, #50, #52, #53, #54, #55, #90, #93, and #94) addressed the need to control rodents on rangelands and croplands, and the economic hardship that would ensue if the Agency cancelled strychnine registrations. Many of the responses were directed toward the prairie dog control operations, but others were directed at uses which the Agency was not proposing for cancellation.

In the case of prairie dog control, the Agency's proposed action was based on two factors: the protection of the endangered black-footed ferret and the registration of zinc phosphide. From the information available to the Agency at the time of the PD 2/3, zinc phosphide was considered to be an efficacious alternative to strychnine.

For other uses for which cancellation was proposed, either adequate alternatives were available or no substantive data or information were received in response to the PD 2/3 which persuaded the Agency to change its position.

Many other comments in this category addressed uses that the Agency was only proposing to modify. The respondents apparently misinterpreted the proposed actions as a proposal for cancellation.

Another group of respondents (#2, #11, #37, and #53) were concerned that EPA was cancelling registrations for pocket gophers. As explained in the PD 1, the RPAR action was only for outdoor above ground uses. Therefore, the use of strychnine to control pocket gophers and moles, if the poison is placed below ground, is not affected by this action.

2. Plague Control

Three respondents (#61, #69, and #71) argued that strychnine is needed for the control of rodents that can be significant plague vectors. The Agency has proposed that the use of strychnine be cancelled for the control of several rodents that could be responsible for plague incidents. The Agency recognizes that strychnine may, in some cases, be the most effective means of controlling rodents when a plague outbreak is occurring or is predicted. The Agency does not believe that this justifies retaining registrations that apply to all uses, when only plague control is required. However, the Agency will consider applications for the use of strychnine in plague control if the registrant is a state or local health department and if the use is limited to plague control only.

3. Marmot/Woodchuck Control

Three respondents (#25, #43, and #52) commented that available alternatives for marmot/woodchuck control are not effective or practical if the dens are located in rock piles or rocky lava outcrops. The Agency agrees that fumigants, the only registered alternatives for marmot control, may not be effective in those locales.

4. Mountain Beaver Control

Respondent #77 requested that registrations be continued for the use of strychnine to control mountain beavers (Aplodontia rufa) in the northwest states. The use of strychnine for "mountain beaver" control is currently registered only in Wyoming. However, this registration is an anomaly since the mountain beaver is not found in Wyoming. If a registrant wishes to use strychnine to control mountain beavers in a particular state, a new application for registration must be made.

5. Need for a Variety of Pesticides

The Agency proposed cancellation of several uses of strychnine, noting that there was usually at least one alternative that was both efficacious and of significantly lower risk to nontarget organisms, especially endangered species.

Several Respondents (#7, #15, #20, #63, #65, #68, and #94) indicated that there was a need to have more than a single rodenticide available to control rangeland rodents. The general reasons for this claim was that either an aversion or "resistance" might develop in populations where control had been inadequate and that a follow-up required the use of a different toxicant.

The Agency does not consider this argument to be persuasive for several reasons. First, there is generally no basis for believing that failure to reduce rangeland rodents by at least 90 percent in any particular year is likely to lead to a substantial loss in forage. Second, poor control is often a consequence of an operator's decision to apply bait under suboptimal conditions, e.g., when rainfall is imminent or when target animals are not accepting the bait in adequate amounts. Finally, the Agency is unaware of any data indicating that an animal made sick by a sublethal dose of zinc phosphide on grain is likely to readily accept grain treated with strychnine soon thereafter. Retreatment, if necessary, should be more successful a year later. Practices which lead to frequent, ineffective treatments should be discouraged on both environmental and economic grounds.

6. House Mouse Control

Three Respondents (#71A, #74, and #76) were concerned that EPA may be proposing the cancellation of strychnine products used to control rodents, particularly house mice, in urban areas. The original RPAR for strychnine was limited to outdoor, above-ground uses only, so consequently no new regulatory action will be taken with regard to house mice.

7. Critical Habitat

Three Respondents (#64, #78A, and #4A) were concerned that EPA was designating the range of the prairie dog as the "critical habitat" of the black-footed ferret. One misinterpreted our rationale to mean that we believe the ferret existed in every prairie dog town.

Our bases for cancelling the use of strychnine for the control of prairie dogs were: 1) the close relationship of the black-footed ferret and the prairie dog; 2) the fact that a ferret could be in any prairie dog town; 3) the inability to reduce the risk sufficiently through modifications in the quantity of strychnine being used; and 4) the absence of a proven search method for

determining that a ferret was not present. The reappearance of a ferret in any area after many years of not being seen does not demonstrate the safety of strychnine. The appearance is more likely a result of the mobility and elusiveness of the ferret.

8. Other Uses

The Agency proposed the cancellation of the use of strychnine to control meadow mice, deer mice and chipmunks on all sites. Two Respondents (#94 and #96) argued that strychnine was needed to control these pests in reforestation areas. However, the information was not specific and no data were provided to persuade the Agency to change its position that the benefits would outweigh the inherent risks of this use. Respondent #94 indicated the need to control jackrabbits at California airports.

B. Proposed Use Modifications

1. Prohibition of Use by County

The Agency proposed a prohibition of the use of strychnine for ground squirrel control in those counties that encompassed the range of several endangered species. The majority of these counties are in California. Respondents #45 and #57 described the inequities that would result in those counties that contain only a small portion of the range of an endangered species.

The Agency agrees that prohibition of use in entire counties may not be necessary in situations when the user either can reasonably be expected to know or can readily determine whether his proposed use of strychnine is likely to expose members of an endangered species to the substance. In California, for instance, plans for using strychnine in each county are reviewed by the Department of Fish and Game according to a Joint Policy Statement (USDA, Exhibit G). While the Agency does not have a good way to judge the effectiveness of these procedures and notes that, at the time PD 2/3 was issued, the program did not include provisions for protecting the Aleutian Canada goose, it agrees that the program generally provides a viable alternative to county-wide bans on use in California.

2. Baiting Practices

The Agency received seven comments (Respondents #5, #12, #15, #34, #37, #47 and #72) that provided information on baiting practices, particularly for ground squirrel control. Apparently, misunderstandings exist regarding the Agency's position since some respondents addressed topics that were not a part of the proposed actions.

The Agency has said nothing that will affect prebaiting. In fact, the Agency's understanding, as exemplified by the benefit analysis, is that prebaiting is often necessary for adequate control to be attained, although prebaiting is not indicated as a recommended procedure on most labels. The Agency is not requiring that the bait be placed in the burrow. Bait will be applied as currently directed on all labels, i.e., scattered around the burrow opening.

Respondent #5 raised the problem of the necessity of bait at the perimeter of a field. This problem arises, for example, when the ground squirrels occupy Federal land but feed on private land. In this case, the burrows are on the

Federal land and the requirement for scattering one tablespoon of bait around the burrow opening obviously is not relevant. Therefore, for those occasions when perimeter baiting is required, it will be allowed provided the label includes appropriate instructions.

3. Retrieval of Uneaten Bait

Two respondents (#15 and #72) questioned the feasibility of requiring that uneaten bait used for horned lark control be gathered at the end of each day. The same requirement applied to the control of birds in orchards and vineyards and for the control of pigeons and house sparrows on nonagricultural sites. In the latter cases, however, the bait is to be placed in troughs or trays and retrieval is practical.

The Agency agrees that retrieving bait applied on the ground between bedded crops would be difficult. The Agency believes, however, that leaving uneaten bait poses a risk to nontarget birds and mammals, and that an effort should be made to reduce the probability of exposure.

4. Retrieval of Dead Animals

The Scientific Advisory Panel and Respondent #72 expressed concern that the retrieval of all dead animals would not be feasible. This provision is part of the modifications to the terms and conditions of registration, intended to reduce the chance of secondary poisoning. The Agency recognizes the difficulty in finding all the dead animals, especially since many will go into shelter before dying. Therefore, the provision will be modified to address this problem (See Conclusions Chapter).

5. Jackrabbit Control

Five comments (Respondents #5, #37, #61, #84, and #85) provided information on the preferred method of baiting for jackrabbit control. The Agency proposal in question was a requirement that bait not be placed in piles for any rodent or lagomorph control operations. Based on the information received, the Agency has determined that this requirement is not accurate for the jackrabbits because they will more readily consume bait placed in a pile on their trails than bait that is scattered.

6. Endangered Species Standard Label

Seven Respondents (#21, #22, #26, #30, #34, #44, and #58) addressed the Agency's proposed label modification intended for the general protection of all endangered species that might be exposed to strychnine during rodent control operations. One response was favorable and the other six, all involved with the forest industry, expressed concern that the modification would severely curtail the ability to use strychnine on porcupine control operations. The primary concern was that the wording implied a requirement for a survey before each control operation and that such a requirement would be too costly and impractical. One respondent suggested prohibiting use in federally-designated critical habitats of endangered species.

The Agency did not intend, in proposing a standard label modification to protect endangered species, that the users of strychnine perform a precontrol survey to determine if any endangered species may be present. The intent was

to make such a determination by contacting the Regional U.S. Fish and Wildlife Service office or the local Fish and Game office. Although the modification was proposed for all outdoor, above ground uses, the Agency understands that the impact would be of particular concern for porcupine control since strychnine is the only toxicant registered for that use.

The Agency believes that the users of strychnine should exercise caution so that endangered species are not placed in jeopardy. The Agency has taken action to protect specific endangered species, but additional precautions are necessary to protect those species that do not have a defined range or critical habitat. This need for additional precautions was the basis for the proposed label modification.

7. Bait Concentrations

The Scientific Advisory Panel and many other Respndents (#4A, #13, #15, #31A, #34, #37, #43, #45, #46, #49, #61, #64, #72, #73, #83, #88, #91, #93, #94 and #96) expressed concern regarding the proposal to reduce the concentration of strychnine in baits for birds and rodents. They all said that the Agency has no data to support these proposals and that further problems would be created with this proposal.

The Agency agrees that it would not be prudent to lower the concentration of strychnine in baits unless data were available to demonstrate that the lower level is efficacious. It has, therefore, attempted to evaluate the benefits acheived in risk reduction against the cost in establishing the efficacy of reduced concentrations. In those cases where benefits appear to exceed costs, the Agency will require efficacy testing.

V. CONCLUSIONS

In the previous chapters, the Agency has reviewed the comments and data received in response to the strychnine PD 2/3. These comments have been analyzed for information that could affect the Agency's decisions and proposed actions. As discussed in the previous sections of this document, most of the comments received did not supply data that could have formed a basis for altering the Agency's risk and benefit analyses. Instead, respondents disagreed with conclusions in general terms.

In this section, each of the Agency's proposed actions will be presented, the arguments concerning each action will be summarized and the Agency's final decision on each use will be presented. In some cases that decision will be the cancellation of or denial of an application for a use, or not to cancel a use if modifications to the terms and conditions of registration are made. Each registrant will be expected to submit their labels to the Agency for review to assure that they are in compliance with the label modifications and the requirements of 40 CFR 162.8.

The Agency's intention is to impose restrictions on uses that are judged as reasonable and prudent to protect endangered species. Generally, judgments are best made by authorities at the local level with restrictions implemented through the understanding and cooperation of affected users. Procedures for implementing this philosophy are in development under the "cluster approach," involving Federal and state government biologists, user groups, industries and environmentalists. At the same time, the Agency will review the development of the restrictions necessary to satisfy the mandates of FIFRA and the Endangered Species Act. The detailed restrictions indicated in this PD 4 serve as an interim solution to the problem and, while the intent will remain unchanged, details may be superceded by the development of more effective procedures.

A. Rangeland and Pasture Uses

1. Prairie Dogs

In the PD 2/3 the Agency proposed cancellation of registrations for use of strychnine to control prairie dogs. The risk to the endangered black-footed ferret, even with possible use modifications, outweighed the benefits of use. The Agency also concluded that zinc phosphide was a viable alternative to strychnine for prairie dog control.

No evidence was presented to demonstrate that the Agency's assessment of the risk to the ferret was in error nor were any methods of eliminating the risk validated. Similarly, no benefit information was presented to alter the risk/benefit conclusions.

None of the respondents proposed a specific method of searching for the black-footed ferret to preclude a risk of secondary poisoning. Moreover, the Office of Endangered Species, Fish and Wildlife Service (Spinks, 1983) indicated that they "...cannot, within the bounds of practicality, make a determination that ferrets are <u>not</u> present in a given dog town with an acceptable degree of probability."

From the data presented, the Agency has concluded that zinc phosphide is a viable alternative if proper attention is given to formulation, handling,

baiting procedures and weather conditions. Although there are some benefits associated with this use, and cost of control would increase using zinc phosphide, this impact is more acceptable than the potential risk to an endangered species. On this basis, the Agency has decided to cancel existing registrations and deny registration applications for use of strychnine to control prairie dogs on all sites.

2. Ground Squirrels

In the PD 2/3 the Agency proposed several risk reduction measures which would allow the use of strychnine to control ground squirrels to be continued such that the benefits would exceed the risks. The Agency has received comments suggesting that this use should be continued, but that certain risk reductions measures be modified. After thorough evaluation of these comments, the Agency has decided not to cancel registrations or deny applications for this use if the following modifications to the terms and conditions of the registration are instituted. This decision is based on the lack of adequate alternatives, the adverse economic impact on users and the availability of risk reduction measures to protect nontarget animals and endangered species. Each of these risk reduction measures is discussed below.

a. Standardize bait concentration at 0.20 percent active ingredient and a dosage of 1 level tablespoon per burrow.

The Agency has received comments from respondants pointing out that without data to show that low dosage levels are efficacious, nontarget organisms may be subjected to greater risks than with the current dosage rates since lower dosages may not work and treatments would likely have to be repeated. The respondents further indicated that sublethal response and poor control of target species are primarily related to: 1) environmental factors which lead to marginal intake, 2) bait concentrations too low to ensure lethal effects, and 3) LD_{50} differences between subspecies (USDI, 1983).

In summary, some of the arguments against the proposal to lower the bait concentrations have validity. As indicated above, the Agency has evidence that indirect poisoning of carnivores may result from the use of strychnine to control ground squirrels, although the evidence is not universal. In view of the extensive use of strychnine on several species of ground squirrel (two-thirds of all outdoor, above-ground uses), substantial reductions in risks might be achieved if reduced formulations are feasible, and preliminary results cited above demonstrate that feasibility. Therefore, the Agency will require through FIFRA section 3(c)(2)(B) that efficacy studies be undertaken for the several ground squirrel species to achieve an optimal balance between risks and benefits.

b. Standardize baiting and post-baiting procedures

The PD 2/3 proposed the following statements:

"Do not expose bait where pets, poultry or livestock are present."

"Do not place bait in piles."

"Pick up and burn or bury all dead animals."

A response to the first statement was a suggestion to modify the statement to read, "Do not expose baits in a manner which presents a likely hazard to pets, poultry, or livestock" (Repondent #61). They asserted that the original proposed statement was too restrictive and would practically prohibit statewide use since there are very few places where free-roaming pets and livestock do not occasionally occur. The Agency agrees that the proposed statement above may be interpreted to be overly restrictive and will therefore adopt the revised statement. There was no concern expressed over the second statement. Comments were received concerning the third label statement to the effect that it is not feasible or enforceable. The Agency believes that to pick up and burn or bury all dead animals would reduce secondary risks to nontarget species but admits that it is not feasible to find all dead animals. However, the Agency has concluded that, to the extent possible, the animals poisoned by strychnine should not be left accessible to carnivores. Therefore, the proposed statement will be modified to read "Pick up and burn or bury all visible carcasses of animals found in or near treated areas."

c. Use bait dyed in accordance with recommendations of the U.S. Fish and Wildlife Service.

The California Department of Food and Agriculture (CDFA) commented that bait coloring requirements should be flexible to the extent of allowing the use of bait dyed in compliance with provisions of the California Vertebrate Pest Control Handbook. These particular requirements provide a means of identifying bait materials for medical and precautionary purposes, preventing use as livestock feed and preventing acceptance by nontarget animals, especially birds.

The Agency agrees that the bait dying requirements should be flexible. In lieu of actual test data, the Agency will rely on the requirements that have been established by the State of California in its Vertebrate Pest Control Handbook on the basis of continuing refinements resulting from many years of research and experience or any other authoritative source.

d. Use restriction for the protection of endangered species

The Agency proposed restriction, by county, in the ranges of the Utah prairie dog, the California Condor, the San Joaquin kit fox, the Morro Bay Kangaroo Rat and the Aleutian Canada Goose. Additionally, restrictions were proposed against use in known gray wolf and grizzly bear areas and baiting ground squirrels within a mile of prairie dog colonies to protect the black-footed ferret.

The Agency has received no written comments on its proposal to prohibit use in the six counties encompassing the range of the Utah prairie dog, but the Office of Endangered Species has advised the Agency that the areas occupied by this species are well known to local operators, obviating the need for county-wide prohibitions. Therefore, the label will state:

"Do not use for ground squirrel control in areas occupied by Utah prairie dogs in Garfield, Iron, Kane, Piute, Sevier and Wayne counties, Utah."

For the protection of the black-footed ferret, the Agency proposed a prohibition on use within one mile of a prairie dog town or an active burrow. The Agency agrees with Timm (1981a) that this proposal would be impractical and difficult to enforce. The counterproposal of a 200 yard buffer zone is

an acceptable compromise that might not totally eliminate risks but should dramatically reduce the risks to the ferret. Therefore, the label provision will state:

> "Do not use for ground squirrel control within 200 yards of prairie dog colonies. Do not use within one mile of a prairie dog colony where the presence of a black-footed ferret has been confirmed within a five year period."

Regarding the PD 2/3 proposed restrictions in California for the protection of the California Condor, San Joaquin Kit Fox, Aleutian Canada Goose, and the Morro Bay Kangaroo Rat, a number of respondents stated that these species were already adequately protected under the Joint Policy Statement of the California Department of Food and Agriculture, California Department of Fish and Game, and the California Agricultural Commissioners Association Regarding Rare or Endangered Species. The Agency agrees that such protective agreements can be effective and therefore will rely on them as long as the California Department of Food and Agriculture submits these guidelines for protecting each species, and any subsequent changes, to the Agency for review and approval.

In summary, the Endangered Species Act provides for the possibility of a civil penalty if an endangered species is killed during a baiting operation. The Agency believes that alerting the users to this possibility will be sufficient to provide the necessary protection without imposing any economic burdens. To protect those species that are classified as endangered, the label will read as follows:

> "Notice: The killing of a member of an endangered species during strychnine baiting operations may result in a fine under the Endangered Species Act. Before baiting, the user is advised to contact the Regional U.S. Fish and Wildlife Service (Endangered Species Specialist) or the local Fish and Game Office for specific information on endangered species. Strychnine baits should not be used in the geographic ranges of the following species except under programs and procedures approved by the USEPA: California Condor, San Joaquin Kit Fox, Aleutian Canada Goose, Morro Bay Kangaroo Rat, Gray Wolf and Grizzly Bear."

3. Other Rodents and Lagomorphs

The Agency proposed in the PD 2/3 the cancellation of the use of strychnine for the control of deer mice, meadow mice, chipmunks and marmots/woodchucks because strychnine poses a risk to nontarget animals, the benefits of these uses is very low and chemical alternatives are available. Comments were received claiming benefits for the control of deer mice, meadow mice and chipmunks, but no data or information specific to the uses was provided to justify their continuation. Consequently, registrations will be cancelled and applications for registration will be denied for these uses.

The Agency proposed in the PD 2/3 the standardization of bait concentrations for jackrabbits, kangaroo rats and cotton rats. Since the Agency does not have data to justify the lowering of bait concentrations and still maintain efficacy, the bait concentrations will remain the same. The use of strychnine for controlling these species is generally infrequent. The Agency believes that efficacy studies are desirable and recommends that concerned parties pursue this objective. The Agency concludes that the lack of specific risk

information and the potential for reducing the risks without affecting the benefits are sufficient for retaining these uses.

The same baiting and post-baiting procedures proposed for ground squirrel control were proposed for cotton rat, kangaroo rat and jackrabbit control. One respondent objected to the Agency proposal to require that bait not be placed in piles for jackrabbit control, because placing bait in piles is more efficacious. The Agency agrees that the proposed requirement is not appropriate for jackrabbit control and will withdraw it. Therefore, the following uses will not be cancelled and applications not denied if the terms and conditions of registration are modified.

For cotton rat and kangaroo rat control, the label requirements will be:

"Do not expose baits in a manner which presents a likely hazard to pets, poultry, or livestock."

"Do not place bait in piles."

"Pick and burn or bury all visible carcasses of animals found in or near treated areas."

For jackrabbit control, only the first and third statements will be required.

As discussed under ground squirrel control, the Agency will require that bait be dyed by a material in accordance with recommendations of the California Department of Food and Agriculture Vertebrate Pest Handbook or other authoritative source.

The Agency proposed prohibitions on use in counties that contain certain endangered species. As previously discussed for endangered species protection in California, the Agency is satisfied that the endangered species will continue to be protected as long as the California Department of Food and Agriculture submits to the Agency its guidelines for protecting each species for review and approval. For the red wolf, the proposed prohibition of use in certain Texas and Louisiana counties will be dropped because viable populations of red wolves are not known to exist in the wild.

As proposed, use for kangaroo rat and jackrabbit control will be prohibited in areas occupied by the Utah prairie dog. Therefore, for the control of these two pests, the following statement must be included on the label:

"Do not use for kangaroo rat and jackrabbit control in areas occupied by the Utah prairie dog in Garfield, Iron, Kane, Piute, Sevier and Wayne counties, Utah."

Also, as proposed, strychnine shall not be used to control jackrabbits and kangaroo rats in areas occupied by the masked bobwhite quail. Therefore, the following statement must be included on the label:

"Do not use for kangaroo rat or jackrabbit control in areas occupied by the masked bobwhite quail in Pima and Santa Cruz Counties, Arizona."

Because all known remaining Dusky seaside sparrows are in captivity, no prohibition on use will be made for Brevard County, Florida, as proposed.

The following two statements must be included on the label used for cotton rat control to protect the Mississippi sandhill crane and the Cape Sable sparrow:

"Do not use for cotton rat control in areas occupied by the Mississippi sandhill crane in Jackson County, Mississippi."

"Do not use for cotton rat control in areas occupied by the Cape Sable sparrow in Collier, Dade and Monroe Counties, Florida."

The following statement must be included on the label used for jackrabbit and cotton rats control to protect the Attwater's greater prairie chicken:

"Do not use for jackrabbit or cotton rat control in habitats occupied by Attwater's greater prairie chicken in the following Texas counties: Aransas, Austin, Brazoria, Colorado, Fort Bend, Galveston, Goliad, Refugio and Victoria."

Additionally, all labels for cotton rat, kangaroo rat and jackrabbit bait will include the warning against endangered species destruction as stated under ground squirrels.

B. Cropland Uses

1. Prairie Dogs

The Agency's decision for the use of strychnine to control prairie dogs on croplands is the same as for rangelands, i.e., cancellation of existing registrations and denial of applications for this strychnine use. Zinc phosphide is not registered for use on cropland. However, the Agency does not believe that the number of prairie dog towns on cultivated cropland are generally significant and control can be achieved by either treating the perimeters of cropland with alternatives before the prairie dogs invade from adjoining areas or by using various fumigants on infested areas where invasion has already occurred.

2. Ground Squirrels

In the PD 2/3 the Agency proposed several risk reduction measures which would allow the use of strychnine to control ground squirrels on croplands to be continued such that the benefits would exceed the risks. The Agency has received comments suggesting that this use should be continued but that certain risk reductions measures be modified. After thorough evaluation of these comments, the Agency has decided not to cancel registrations or deny applications for this use if modifications to the terms and conditions of the registration are instituted. This decision is based on the lack of adequate alternatives, the adverse economic impact on users and the availability of risk reduction measures to protect nontarget animals and endangered species. The modifications are the same as previously required for use to control ground squirrels on rangeland and pastures.

3. Other Rodents and Lagomorphs

Registrations will be cancelled and applications denied for use to control deer mice, meadow mice, chipmunks and marmots/woodchucks on cropland because

of the risks to nontarget animals and because the benefits of these uses are very low.

The decision for cotton rat, kangaroo rat and jackrabbit control are the same as for the use on rangelands, i.e., the continued registration if the terms and conditions of registration are modified. The Agency's rationale for this decision is that there is a lack of specific risk information and there is the potential for reducing the risks without impacting the benefits. The same risk reductions measures as required for other rodents and lagomorphs in rangeland and pastures apply here.

C. Nonagricultural Sites

1. Rodents

In the PD 2/3 the Agency proposed cancellation of registrations for the use of strychnine to control prairie dogs, deer mice, meadow mice, chipmunks, marmots/woodchucks, cotton rats, kangaroo rats, jackrabbits, mountain beavers, opossums and rabbits.

The rationale for the Agency's decision to cancel registrations and deny applications for registration for the use of strychnine to control prairie dogs on nonagricultural sites is the same as for rangeland and pastures, i.e., the risk to endangered species (black-footed ferret) and the availability of a viable alternative, zinc phosphide.

The Agency's rationale for the cancellation of registrations and denial of applications for registration for the use of strychnine for the control of deer mice, meadow mice, chipmunks, cotton rats, kangaroo rats, opossums and rabbits is the risk to nontarget animals, the benefits of these uses are very low and chemical alternatives are available. The pest designation for "mountain beaver" was considered to be invalid.

The Agency has received comments that marmot/woodchuck control should be retained with use modifications because there are no effective alternatives for control in rock-piles and rocky lava outcrops. The Agency agrees with these comments and will retain the use of strychnine for marmot/woodchuck control on these sites because the fumigant alternative is not effective there. The Agency will not now require bait concentrations to be lowered, but efficacy testing will be encouraged.

As discussed under ground squirrel control, the Agency will require that bait be dyed in accordance with the recommendations of the California Department of Food and Agriculture Vertebrate Pest Control Handbook or other authoritative source.

The following use modifications are required to appear on the label to reduce exposure to nontarget animals:

"The use is limited to areas where the dens are located in rocky areas where fumigants cannot be used."

"Do not expose baits in a manner which presents a likely hazard to pets, poultry or livestock."

"Do not place bait in piles."

"Pick up and burn or bury all visible carcasses of animals found in or near treated areas."

The Agency will continue the registration for the control of jackrabbits only around airports. The presence of jackrabbits at airports poses a potential threat to air traffic because they attract large raptors and other predators which may collide with aircraft. Therefore, the Agency has concluded that there is a substantial need to retain this use.

Ground squirrel control will be permitted with the same requirements as those for ground squirrels on rangeland and pastures because the Agency has concluded that the benefits exceed the risks if the same modifications to the terms and conditions of the registration are made.

Finally, porcupine control will be permitted because the benefits exceed the risks, provided that the proposed restrictions are adopted to reduce exposure of bait to nontarget animals and endangered species. Therefore, registrations for this use will not be cancelled nor applications denied if the following modifications to the terms and conditions to registration are made. The label will read as follows:

"Treated salt blocks will be nailed at least ten feet above the snowline."

"Use is prohibited in areas known to be occupied by the gray wolf or grizzly bear."

D. Birds on Croplands

In the PD 2/3 the Agency proposed the adoption of modifications to the terms and conditions of registration for the use of strychnine to control various species of birds on croplands. One of the modifications was to lower the concentration of strychnine in the baits. The Agency has received comments from respondents pointing out that without data to show that low dosage levels are efficacious, nontarget organisms may be subjected to greater risks than with the current dosage rates since lower dosages may not work and treatments would likely have to be repeated. Some of the arguments for maintaining a range in strychnine concentrations that vary with the target species have validity. Due to the lack of efficacy data on bait concentrations with which to determine the lowest efficacious dose of strychnine for each avian target species, the Agency agrees that the current bait concentrations should not be changed unless appropriate data are available.

The Agency has no direct evidence that substantial risks to nontarget species has resulted from these uses and the sites of application (orchards, vineyards, cultivated fields) and methods of placing bait do not lead to the conclusion that risks are likely to be great if label precautions are followed. While reductions in bait concentrations are considered desirable, it does not necessarily follow that substantial benefits in risk reduction would be anticipated. A requirement to conduct such studies does not appear warranted at this time.

The Agency's decision is to retain the use of strychnine to control birds on croplands because of the reduction risks to nontarget animals and endangered species through label modifications, the absence of comparative data on altern-

atives and the potential for local impact on benefits. Therefore, registrations for these uses will not be cancelled nor applications denied if the following modifications to the terms and conditions of registration are instituted.

The following baiting and post-baiting procedures must appear on the labels to help keep the baits out of the reach of nontarget animals and to help reduce the chances of secondary poisoning through the consumption of poisoned target species.

For the control of birds in orchards and vineyards:

"Bait must be placed in troughs no less than three inches deep (v-shaped with ends blocked to avoid spillage)."

"Troughs must be removable so that they can be cleaned out after each change of bait."

"Troughs must be at least four feet from ground level."

"Place troughs within the orchards or vineyards where damage exists or is about to occur."

"Expose poisoned bait sparingly - one-half inch deep in each trough."

"Pick up and dispose of any bait spillage daily."

"Pick up and burn or bury all visible carcasses of birds at the end of each day."

For the control of horned larks on crops:

"Expose bait sparsely in a depression between bedded crops."

"Pick up and dispose of any bait spillage."

"Pick up and burn or bury all visible carcasses of birds at the end of the day."

Additionally, all labels will include the warnings against endangered species destruction as stated under ground squirrel control in rangeland and pastures.

E. Birds on Nonagricultural Sites

In the PD 2/3 the Agency originally proposed the adoption of modifications to the terms and conditions of registration for the use of strychnine to control birds on nonagricultural sites. The comments received on this proposal were similar to those received on the proposal for bird control on croplands. The Agency has concluded that because the lack of specific risk information (with the exception of the risk to the peregrine falcon), the potential for eliminating the risk to the peregrine falcon through the use of risk reduction measures, and the potential benefits of disease control, the registrations for control of certain birds on nonagricultural sites should be continued. In the PD 2/3 there was no proposal to reduce the bait concentrations for pigeon and house sparrow control because the labels were uniform in this respect. However, risks of indirect exposure from these uses are apparent and, while steps have been to prevent exposure to the peregrine falcon, risks to other raptors and

carnivores have not been reduced. The Agency recommends that concerned parties consider undertaking studies of efficacy to develop a better balance between risks and benefits. Registrations for pigeons and sparrows will not be cancelled nor applications denied if the following modifications to the terms and conditions of the registration are made.

The following baiting and post-baiting procedures must appear on the labels to help keep the baits out of the reach of nontarget animals and to help reduce the chances of secondary poisoning through the consumption of poisoned target species.

"Pick up and dispose of uneaten pigeon bait after 3 days of exposure per site."

"Inspect each site for nontarget species hazard daily."

"Where uneaten bait is not easily retrievable, place bait in trays or v-shaped troughs."

"Pick up and burn or bury all visible dead birds daily."

"The use to control pigeons and sparrows will be prohibited in the following areas for the protection of endangered species:

Species	Prohibited Area
Yellow-shouldered blackbird	Puerto Rico
Puerto Rican Plain Pigeon	Puerto Rico
Peregrine falcon (pigeon control only)	Do not use within 5 miles of aeries or critical habitats. Do not use when migratory falcons may be present. Consult with local fish and game or regional Fish and Wildlife Service."

F. Summary

For rangeland and pasture uses, the final action for each pest is:

ground squirrels	-	modification of the terms and conditions of registration and the requirement for additional data
prairie dogs	-	cancellation
deer mice	-	cancellation
meadow mice	-	cancellation
chipmunks	-	cancellation
marmots/woodchucks	-	cancellation
cotton rats	-	modification of the terms and conditions of registration
kangaroo rats	-	modification of the terms and conditions of registration
jackrabbits	-	modification of the terms and conditions of registration

For cropland uses, the final action for each pest is:

ground squirrels	-	modification of the terms and conditions of registration and the requirement for additional data

prairie dogs	-	cancellation
deer mice	-	cancellation
meadow mice	-	cancellation
chipmunks	-	cancellation
marmots/woodchucks	-	cancellation
cotton rats	-	modification of the terms and conditions of registration
kangaroo rats	-	modification of the terms and conditions of registration
jackrabbits	-	modification of the terms and conditions of registration
birds	-	modification of the terms and conditions of registration

For nonagricultural site uses, the final action for each pest is:

ground squirrels	-	modification of the terms and conditions of registration and the requirement for additional data
prairie dogs	-	cancellation
deer mice	-	cancellation
meadow mice	-	cancellation
chipmunks	-	cancellation
marmots/woodchucks	-	modification of the terms and conditions of registration
cotton rats	-	cancellation
kangaroo rats	-	cancellation
jackrabbits	-	modification of the terms and conditions of registration
mountain beavers	-	cancellation
opossums	-	cancellation
rabbits	-	cancellation
porcupines	-	modification of the terms and conditions of registration
pigeons	-	modification of the terms and conditions of registration
house sparrows	-	modification of the terms and conditions of registration

The modifications include uniform baiting and post-baiting procedures, geographical restrictions for the protection of endangered species or limitations to the allowable sites of application. The requirement for additional data includes the determination of the lowest efficacious bait concentration for ground squirrels. These data will be required under section 3(c)(2)(B) of FIFRA.

The Agency has taken steps to rectify the most serious problems associated with the outdoor above-ground use of strychnine, namely that of the significant reduction in populations of nontarget organisms and fatalities to members of endangered species. These steps include the cancellation of certain uses and the modification of label statements to afford better protection to these nontarget species. By weighing the risks and benefits associated with strychnine use, the most important (i.e. higher benefit) uses have been retained, and a number of relatively minor uses have been cancelled. The Agency will require efficacy data on bait concentrations for ground squirrels be generated to be used to set the lowest efficacious level. This step will also help to afford better protection to the nontarget organisms.

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76A	Richard V. Carr, Ph.D Director of Research National Pest Control Association, Inc. 8150 Leesburg Pike, Suite 1100 Vienna, VA 22180	3/25/81

List of Respondents 30000/7B

Respondent Number	Name	Date
77	W.H. Koresan Department of Agriculture Agriculture Building 635 Capitol Street, N.E. Salem, OR 97310	4/6/81
78	Larry J. Bourret Commissioner Wyoming Department of Agriculture Cheyenne, WY 82002	4/29/81
78B	Larry J. Bourret Commissioner Wyoming Department of Agriculture Cheyenne, WY 82002	5/19/81
78C	Larry J. Bourret Commissioner Wyoming Department of Agriculture Cheyenne, WY 82002	6/11/81
79	James W. Flynn, Director State of Montana Department of Fish and Game Helena, MT 59620	10/5/81
80	C. Ray Record Frontier Pest Control Rt. 1, 1003 Eagle Watch Stevensville, MT 59870	10/13/81
81	Anson R. Bertrand, Director Science and Education Department of Agriculture Office of the Secretary Washington, D.C. 20250	10/30/81

Exhibits (Full citations in the Bibliography)

A. U.S. Department of Agriculture (1980)
B. U.S. Department of Agriculture (1977)
C. Salmon (1981)
D. Wade (1981)
E. Timm (1980)
F. Timm (1981a)
G. California Department of Food and Agriculture (1980)
H. PSS & Associates (1981)
I. U.S. Department of Agriculture (a)
J. U.S. Department of Agriculture (b)
K. Timm (1981b)
L. Miller, Warren, and Gohre (1981)
M. Ketron, Inc. (1979)

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82	John O'Brian State of Nevada Department of Agriculture P.O. Box 11100 Reno, NV 89510-1100	8/5/83
83	Gene Erquiaga Modoc County Farm Bureau P.O. Box 1692 Alturas, CA 96101	8/9/83
84	John O'Brian State of Nevada Department of Agriculture P.O. Box 11100 Reno, NV 89510-1100	8/2/83
85	Keith Kelly, Director State of Montana Department of Agriculture Agriculture/Livestock Bldg Helena, MT 59620-0201	7/28/83
86	David W. Pratt Lake County Farm Bureau 65 Soda Bay Road Lakeport, CA 95453	7/15/83
87	S.W. Strew Calif. Agri. Production Consultants Association 100 Valley View Drive Petaluma, CA 94952	7/8/83
88	Wm. B. Staiger CA Cattlemen's Association 1005 12th Street, Suite A Sacramento, CA 95814	7/11/83
89	Charles Mehlschau San Luis Obispo County Farm Bureau 651 Tank Farm Road San Luis Obispo, CA 93401	7/11/83
90	Louis and Phyllis Bergman Rt. 1, Box 88 Paso Robles, CA 93446	7/6/83

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Respondent Number	Name	Date
91	George F. Pride County of Glenn Board of Supervisors 526 West Sycamore Street P.O. Box 391 Willows, CA 95988	7/5/83
92	Joe F. Alvernaz Merced County Farm Bureau P.O. Box 1232 646 S. Los Banos Hwy Merced, CA 95341	7/1/83
93	Jerry Diefenderfer Board of Supervisors County Government Center San Luis Obispo, CA 93408	6/28/83
94	Clare Berryhill, Director State of California Department of Food and Agriculture 1220 N Street Sacramento, CA 95814	6/6/83
95	Walter E. Howard Department of Wildlife and Fisheries Biology University of California Davis, CA 95616	5/12/83
96	Robert A. Jantzen, Director U.S. Fish and Wildlife Service U.S. Department of the Interior Washington, D.C. 20240	6/24/83